Renewable Energy Advances and Global Climate Change

Integrated Energy Policy Report

Renewables Joint Committee Workshop

California Energy Commission

June 24, 2003

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Impacts of Renewable Energy on GCC Gases

- ***Direct Reduction of GCC Gases***
  - ***Reducing methane emissions***
    - ***Landfills (> 300 active landfills: 13 MMTCO$_2$ *: 42%)***
    - ***Livestock manure (> 2100 dairies: 5 MMTCO$_2$: 22%)***
    - ***Sewage treatment facilities (> 200 facilities: 1.4 MMTCO$_2$: 4%)***
  - ***Reducing CO$_2$ emissions***
    - ***Wildfires (sink of ~ 18 MMTCO$_2$: forests the biggest sink for CO$_2$)***
    - ***Open field burning (potential sink of 2.6 MMTCO$_2$)***
- ***Indirect Reduction of GCC Gases***
  - ***Reducing fossil fuel use***
    - *Non-combustion renewables*
    - *Increased use of wind, solar, geothermal, etc.*

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Advanced Technologies for Methane Reduction from Landfills

- ***Landfill Gas***
  - ***Issues Facing Development***
    - ***High costs***
    - ***Long capital recovery***
  - ***Yolo's Bioreactor Approach***
    - ***Accelerates methane capture***
    - ***Increases cost effectiveness***
    - ***Saves landfill capacity***
  - ***Commonwealth Energy***
    - ***Extending Yolo's approach***
    - ***Commercial size***
    - ***Simplified operation***

Control cell without bioreactor

Enhanced bioreactor cell

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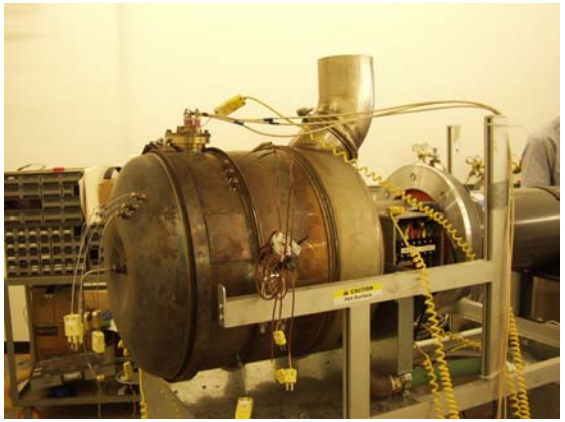
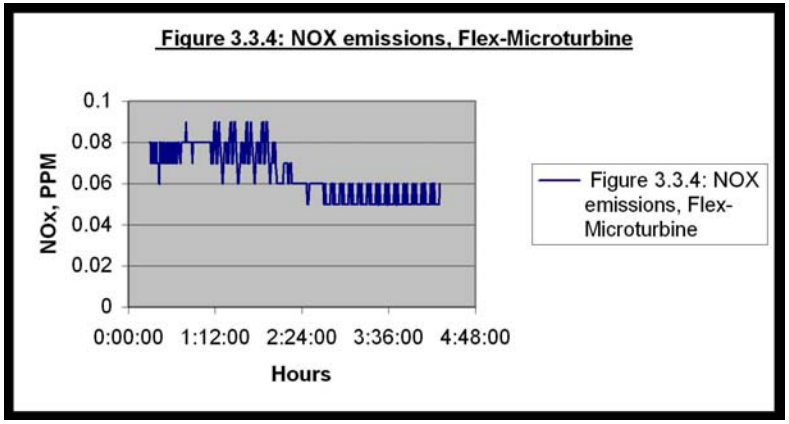
Advanced Technologies for Methane Reduction from California Dairies

- ***Digester Gas from Dairies***
  - ***Issues Facing Development***
    - ***High Capital Costs***
    - ***NOx emissions for CARB DG 2007 requirements***
  - ***Valley Fig***
    - ***Increased efficiencies***
    - ***Reduced capital costs***
  - ***FlexEnergy***
    - ***Low NOx (< 1 ppmv)***
    - ***Can handle very low Btu gases***





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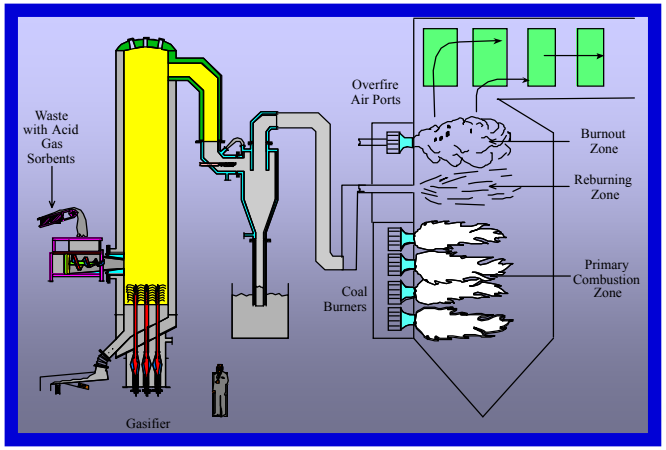
Advanced Technologies for Retaining or Improving CO_2 Sinks

- ***Wild Fire Reduction***
  - ***CPC's BioMax System***
    - ***Demonstrated at Hoopa Valley on Thinnings***
      - ***Small Footprint***
      - ***Capability for load following/ good DG profile***

- ***Reduced Open Field Burning***
  - ***TIAX's Co-Fired System***
    - ***Demos at Burney and Fairhaven Biomass Plants***
      - ***Added Peaking Capability***
      - ***Lower NOx***



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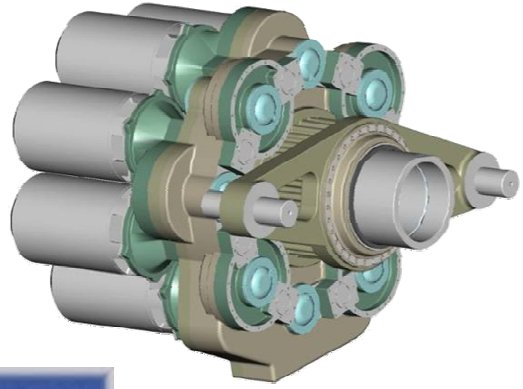
Advanced Wind Energy Technologies

- ***CA Wind***
  - ***1700 MW and over 3000 GWhrs/yr***
  - ***Issues:***
    - ***Capacity value, reliability***
- ***WTC's Advanced 2 Bladed Turbine***
  - ***Targeting $0.03/kwhr***
    - ***Demonstrated at NREL and Fairmont (CA)***
- ***Clipper's Distributed Generator System***
  - ***Higher Reliability & Lower Costs***
    - ***Prototype under development***



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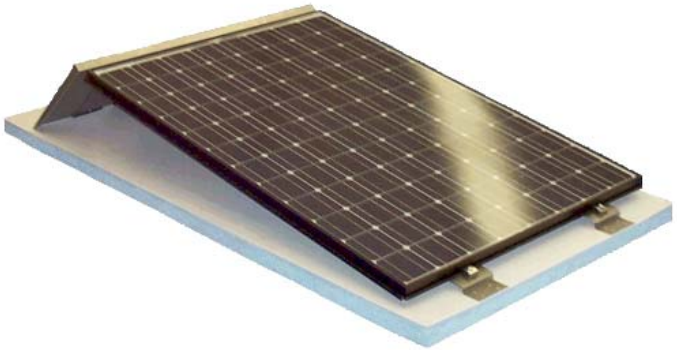
Advanced Solar Technologies

- ***CA Solar***
  - ***400+ MW and 900 GWhrs/yr***
  - ***Issues:***
    - ***High costs, low acceptance***
- ***Expanding PV Roofing Options***
  - ***PowerLight Corporation***
    - ***Extending PowerGuard to residential sector***
  - ***UNI-Solaott's Laminate Batten System***
    - ***Lower cost commercial applications***



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Advanced Geothermal Technologies

- ***CA Geothermal***
  - ***2500 MW and 13,600 GWhrs/yr***
  - ***Issues:***
    - ***Costs, locations***
- ***Reducing Exploration Costs***
  - ***EMI's GeoBilt Project***
    - ***3 dimensional imaging***
    - ***Could reduce drilling exploration costs by over 20 percent***

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